SOUTH AMERICAN TRIBES AND LANGUAGES.

IN the February number of the Journal of the Anthropological Institute, Mr. Clements R. Markham, republishes his 'List of Tribes in the valley of the Amazon,' which first appeared about twenty years ago. Of course there are many improvements in the enumeration; but it is amazing to note that by far the best recent authorities are not referred to, and their material is ignored. In the 'list of authorities' there is no mention, for instance, of the names of Von Den Steinen, Ehrenreich or Barbosa Rodriguez. For the linguistics he quotes Dr. Latham as still the authority. In fact, the best work done in Amazonian ethnography within the last decade is not mentioned nor utilized.

Some interesting studies in the languages of the Argentine Republic should not be overlooked. The Allentiac was a language, now extinct, spoken in the vicinity of San Juan de la Frontera. A little catechism, grammar and vocabulary of it was printed by Father Louis de Valdivia in 1607, of which only one perfect copy is known. This has been edited with a useful introduction by José T. Medina (Sevilla, 1894), and has been made the subject of a neat study by General Bartolome Mitré (Estudio Bibliografico linguistico de las Obras de Valdivia, La Plata, 1894; pp. 153). He inclines to consider it a separate stock.

The well-known Argentine linguist, Samuel A. Lafone Quevedo, has added another to the list of his valuable monographs by a thorough study of the mysterious Lule language (Los Lules; Estudio Filologico, Buenos Aires, 1894, pp. 145). It is based, of course, on the grammar of Machoni, and reaches the conclusion that the modern are not the ancient Lules, and Machoni's grammar is that of a tongue which belongs with the Quichuan group, and not among those of the Gran Chaco.

D. G. BRINTON.

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CORRESPONDENCE.

A LARGE REFLECTOR FOR THE LICK OBSERVATORY.

MR. EDWARD CROSSLEY, F. R. A. S., of Halifax, England, has offered to present his 3-foot reflecting telescope to the Lick Observatory with its apparatus and dome, complete. The grateful thanks of the Observatory are returned for this generous and highly appreciated gift.

EDWARD S. HOLDEN.

MOUNT HAMILTON, April 4, 1895.

SCIENTIFIC LITERATURE.

Alternating Generations. A Biological Study of Oak Galls and Gall Flies. By HERMAN ADLER, M. D. Schleswig. Translated and edited by CHARLES R. STRATON. New York, Macmillan & Co.

The recent appearance, from the Clarendon press, of an edition of Dr. Herman Adler's celebrated work, which was published some fourteen years ago, on alternating generations among the Cinipidæ, being a biological study of oak galls and gall-flies, will be welcomed by all interested in the subject, especially by those who do not read German or French. The English translation is by Charles R. Straton. The work consists of: (1) an introduction by the editor; (2) the translation proper, to which the editor has added, in brackets and in smaller type, the popular English name of the gall, the particular oak upon which it is found, and a list of the inquilines and parasites that have been reared from each species; (3) as Appendix I., by the editor, a full account of *Cynips kollari* Hartig; (4) as Appendix II., a synoptical table of oak galls; (5) as Appendix III., a classification of the Cynipidæ, and (6) a bibliography.

The synoptical table of oak-galls (Cynipidæ alone included) is based on European species; while the classification includes not only European but a certain number of

the older American species, but it is very imperfect in taking no note of the many later described American species, especially those described by Ashmead and Gillette. The classification is based on Mayr's, as was that given in Lichtenstein's translation of 1881, and comparatively few additional species are included.

The introduction is very full and includes a discussion of heredity and a rather full summary of late embryologic work, with a view of getting a clearer conception of the philosophy of alternation in generations. Mr. Straton particularly discusses Weismann's views, but by no means accepts them, though a thorough believer himself in natural selection.

Straton points out "that galls may be arranged in groups of greatly increasing complexity and that they must have arisen by gradual and complete improvements in the initial stages of their formation, acting through natural selection over an unlimited period of time and through numerous consecutive species." Each infinitesimal improvement in the gall itself, internally or externally, which has been of service as a protection against parasites or as favoring the development of the larva, has been preserved. In this view of the case, which is one that certainly seems most reasonable, the various characteristics of galls, such as spines, prickles, glutinous secretions, induration, and even size and coloration, are all acquired characteristics for the protection of the larva within. This theory is certainly justified in a large number of cases, but is equally at fault in many others. It would be hard to conceive that the bright colors which many galls assume in an early stage of development or the succulent character and pleasantly sub-acid or fruity flavor of others which renders them so prone to be invaded and preyed upon by a host of other insects could have any relation to the benefits of the gall-maker within. Here, as in most other natural history phenomena, natural selection can hardly be considered an all-sufficient explanation. Likewise, the assumed protective colors which galls often take on in autumn will find more valid explanation in the same causes which produce the similar changes in the leaves themselves, which can have no reference to the welfare of the plant.

No subject connected with galls has perhaps been more written about than the inciting cause of their formation. Adler and Byerinck effectually disproved the older belief that the exciting poison was inserted by the parent in the act of oviposition, *i. e.*, that the initial force was due either to a chemical secretion injected by the gall-mother or to the mechanical stimulus of traumatic irritation. A fluid is secreted in the act of oviposition, but it is absolutely unirritating and acts primarily as a lubricant to facilitate the arduous mechanical act and probably also as a mild antiseptic dressing to the wound made in the plant. Nevertheless there is an irritating salivary secretion produced by the larva itself and the gall growth is co-incident with the hatching and feeding of this larva. The fact that the influence on the plant tissues sometimes begins before the egg-shell is ruptured indicates that this fluid possesses amylolytic and proteolytic ferments. That the influence should be slightly exerted prenatally is not to be wondered at when we consider the delicate nature of the egg covering which often makes it difficult to observe the dividing line between the egg and newly hatched larva.

While, therefore, it is the larva in the Cynipidæ which causes the gall, this is not the case with the many other gall-producing insects, since many of the gall-gnats (Cecidomyidæ) and most, if not all, of the gall-making saw-flies (Tenthredinidæ) secrete a poison in the plant tissue in the act of oviposition, causing the gall to form be-

fore the larva hatches. One must, therefore, in reading Straton's Introduction, bear in mind that he is treating solely of the Cynipidæ. Adler himself recognizes the fact, so far as the *Tenthredinidæ* are concerned, from observations on *Nematus vallisnerii*, which produces a gall on *Salix amigdalina;* but in sweepingly denying it for the gall-gnats (p. 100), on the score that they have no piercing apparatus, he makes one of those generalizations which the facts do not justify, as most of the gall-making species have a very effective and specialized piercing ovipositor. This is, of course, not homologically comparable to that of the Hymenoptera, but is no more exceptional than is the wonderful piercing apparatus of Pronuba among Lepidoptera, being, like this last, a modification of the tubular tip of the abdomen and of the chitinous rods connected therewith.

Adler shows very conclusively that, in spite of the great variation in form, size, appearance and manner of formation, or whether they grow from bud, blossom, leaf, bark or root, galls spring invariably from the zone of formative cells or the cambium ring, just as indeed does the whole life of the plant. These cells are the theatre of actual metabolism. They are not differentiated into stable tissue, but await a period of developmental activity and possess the very conditions essential to gall formation. This explains the fact that Cynipid galls formed from punctures in the leaf almost always begin on the under surface of the leaf, since the cells of the upper surface have become stable and do not respond to any irritation applied to them; while when the eggs are laid in a dormant bud containing rudimentary leaves consisting of unmodified cells, both surfaces may take part in gall formation, the resulting gall, in such case, growing through the leaf substance. Again, when the egg is laid in the cambium ring of the bark, there is a sharp zonal contrast in the resulting gall between the soft and sappy parenchymatous cells and a harder central zone of wood parenchyma corresponding to the bast and to the wood parenchyma, the softer parts of the gall projecting from the bark while its woody base penetrates into the woody tissue.

From the above facts we come to understand why from winter buds, *i. e.*, where eggs are laid during winter in a bud that is dormant, only bud galls are produced, while from buds pierced in spring, when metabolism has begun, we get leaf-galls. Moreover, it has been proved by Adler, and explains the many failures in the efforts to obtain gall growths by confining gall-flies upon the plants, that if the parent fly fails to reach the formative zone of cambium cells the larva on hatching perishes without forming a gall. Another interesting fact which the writer has observed is that where but one bud-gall is usually produced several eggs are nevertheless inserted in the bud by the parent, a prodigality not uncommon in insects under similar circumstances, and which has some profound significances which we cannot discuss in this connection.

On the question as to what determines the ultimate growth of each particular gall so characteristic of its species Adler ventures no theory or explanation; but all the facts would indicate that it depends on the specific quality of the larval secretion, each having its distinct form of morbid poison working in the same pathologic way as the virus of the various eruptive diseases of man. Bacteriology may, in fact, yet come to our aid in this connection, as it has in the study of the pathologic manifestations of higher animals.

The process of oviposition in the Cynipidæ is a very elaborate one and has been much written about. Adler gives a most full and elaborate description of the mechanism of the ovipositor, and particularly of the ventral plates and bundles of muscles by which

the terebra is worked. The structure of the ovipositor is well known and its parts homologize with those of the same organ in all Hymenoptera. It consists of a large bristle or seta, and of two spiculæ which mortise into it by means of two tenons and form the channel down which the egg passes. The seta occupies half the area of a transverse section of the terebra, and the two spiculæ occupy the other half. The seta has a central canal which contains an air vessel, a nerve branch and some sanguineous fluid. While appearing like a single piece, it is in reality double or composed of two parts which, indeed, are separated at the extreme base, but otherwise firmly soldered together. The spiculæ are serrate or notched near the tip, and the seta often ends in a slight hook. The two spiculæ play by means of strong basal muscles, longitudinally up and down on the tenons of the seta.

The eggs of Cynipidæ are characterized by having a stalk or pedicel of varying length according to the species, the egg-body proper, according to Adler, being at the apical or anterior end which first issues from the body, and the posterior end being also somewhat enlarged or spatulate. In repose the ovipositor is concealed within two sheaths, but in oviposition, according to Hartig's views, the spiculæ grasp the egg-stalk and push it to the tip, the fluids in the egg-body being pressed back in the operation, so that they come to be distributed along the stalk or to lie at the opposite or posterior pole of the stalk. The spiculæ then slightly separate at the tip from the seta and extend beyond it so that the apical end of the stalk becomes free. Now by pressure the fluid at the posterior end passes back through the stalk into the opposite or apical end which is plunged in the plant, the basal portion becoming emptied, the swollen apical end thus remaining in the plant when the ovipositor is withdrawn, filling the distal end of the puncture, which is somewhat enlarged. The empty basal sack of the egg and a portion of the stalk are often left exposed, looking not unlike the empty egg of some lace-wing fly (Hemerobiid).

In short, Hartig's view, very generally adopted, was that the extensile and ductile egg was driven through the ovipositor itself while this was in the plant, and that the contents of the egg-body were pressed back into the egg-stalk or pedicel during the operation and collected in the posterior end, and only after the apical end had reached the bottom of the puncture did these contents stream back into it. Adler would refute this view and draws attention to his own figures on Plate 3, where the eggs and ovipositor are illustrated side by side, all taken from photographs and drawn from the same amplification. These show that the ovipositor is, in every case, longer than the egg itself, the enlarged head of the egg corresponding in direction to the tip of the ovipositor. He argues from this fact that one end of the egg cannot be in the plant tissue while the other is in the canal. He further argues that it is not possible that the whole egg can be received into the ovipositor and glide through it in the way in which Hartig supposed. The operation of oviposition according to his observations consists of three distinct stages: (1) The canal in the plant is first bored, after which the fly rests; (2) the egg is then passed from the ovarium to the entrance or base of the ovipositor, *the anterior swollen end or egg-body hanging out*, since it is too large to be passed down the channel. It is then pushed along by means of the egg-stalk behind being grasped between the two spiculæ. (3) Finally, when the egg-body reaches the perforation, the ovipositor is partially withdrawn and the whole egg is then pushed in till the egg-body reaches the bottom of the puncture. Adler rightly expresses wonder

that this complex procedure should be repeated so often with such great accuracy, and proceeds to describe the tactile hairs connected with the ovipositor which permit the fly to carry out the operation. He further states that, while oviposition in the surface of leaves is in its nature easier, the mechanism of oviposition is exactly the same as in buds.

We thus have two diametrically opposed views as to how the Cynipid egg passes down the ovipositor, the oviduct or passage of which is but one-fourth as wide as the egg-body itself, and into the puncture prepared for it. Hartig gave a perfectly simple explanation, and one generally accepted. While it is difficult to understand how the egg can be pushed into the puncture with the swollen egg-body entering first, yet Adler goes into elaborate details and is so careful that one is scarcely justified in questioning his conclusions. There is, however, good reason for doubting their accuracy as applied to all species and for believing that the method described by Hartig does also obtain and that there are even further modifications of the process.

In controverting Hartig and referring to his figures of eggs and ovipositors, Adler gives no indication whether the eggs were taken from the buds after being deposited, or from the ovaries or from the ovipositor, and my own experience with these and other ductile and extensile eggs with long egg-stalks would indicate a very varying length of stalk according to these varying circumstances. Again, he evidently has misjudged Hartig in assuming that the latter describes the passing of the egg down the minute channel of the seta, for Hartig's figures, as well as his description, make it clear that he had in mind the actual facts, viz., the passage of the egg down the channel formed by the connection of the two spiculæ with the seta. He is quite clear on this point and refers to the seta as the egg-guide (Eileiter) and not as the oviduct. He also elaborately describes and figures the eggs in the ovaries, with the swollen egg-body away from and the stalk directed to the base of the ovipositor.

My own studies of the oviposition of *Callirhytis clavula* O. S. in the buds of *Quercus alba* in April show that the eggs are inserted by the egg-stalk into the substance of the leaf, and that the fluids are first gathered in the posterior end which is not inserted. The fluids are then gradually absorbed from this exposed portion into the inserted portion of the egg and by the time the young leaves have formed the exposed shells are empty, the thread-like stalk has disappeared and the egg-contents are all contained within the leaf tissue. The larva now hatches and young galls rapidly form, the colorless and shriveled egg-shell being still often exposed in position and generally some distance from the position of the larva, a difference doubtless representing the original length of the inserted egg-stalk.*

These observations certainly comport more with the conclusions of Hartig than of Adler, though they indicate a quite different

* This agamic gall-fly produces a hemispherical gall involving both sides of the leaf, the cells in the center being connected by loose spongy fiber, and from it comes the sexual species, *Callirhytis futilis* O. S. This in turn produces the twig gall from which the agamic *C. q-clavula* is derived. Mr. H. F. Bassett (*Psyche*, Vol. 5, pp. 235–8, December, 1889) has connected *Callirhytis futilis* O. S. with a new species which he there describes as *Callirhytis radicis*, reared from a gall which is, practically, a blister-like swelling of the root. There is here either an error as to determination or else we have another interesting discovery in connection with these insects, viz., that the same species may indifferently produce a gall on the root or on the twig. When we remember how readily nature in many cases will convert a root into a twig, and *vice versa* this last explanation will not appear so improbable. I may add that Mr. Ashmead, who has reared the fly from the *clavula* gall, has carefully compared it with those actually observed ovipositing in the buds and agrees with me that they are identical.

method of oviposition from that described by either, in that the fluid egg-contents are not passed from one pole to another rapidly in the act of oviposition as described by Hartig, but very gradually, the process not being completed till just before the hatching. I had the assistance of Mr. Th. Pergande in carefully watching the steps in this particular case (in April 1884) and have put them on record here for the first time. Again, a small black wingless species (*Biorhiza nigra* Fitch, subsequently described as *B. politus* by Bassett), is not infrequently found during winter under the shelter of bark scales and oviposits during late winter in the terminal buds of *Quercus alba* and *Q. obtusiloba*. The ovipositor in this case, as in most cases where eggs are laid in dormant buds, is thrust down between the bud-scales until it reaches the soft latent cell tissue toward the center of the bud. And here it is easy to observe, by removing the scaly coverings, as I have done, that the pedicel or stalk only is inserted in the embryo leaf-tissue and that the enlarged portion or egg-body is at first external, being pressed and somewhat flattened by the surrounding leaf-scales.*

In still a third case of a small black inquiline (*Ceroptus politus* Ashm.) oviposition was observed by Mr. Pergande in the mid-rib of *Quercus rubra*, May 20, 1894 ,and in this case, as my notes show, the egg is thrust down into the puncture made by the terebra in the mid-rib until not a vestige of the egg is visible, the pedicel being very short.

There is, therefore, good reason for believing that oviposition in these insects follows no uniform system, and there is a serious question whether Adler's rejection of Hartig's views are justified. In connection with Adler's views as to oviposition, he concludes from his own studies that the main purpose of the egg-stalk is to supply oxygen to the egg-body in the plant-tissues, but that this is also an erroneous conclusion is, I think, made manifest by some of the facts just stated. That the function of the egg-stalk is, rather, to facilitate the otherwise difficult mechanical operation of the passage of the egg down a narrow and elongate ovipositor in the manner indicated by Hartig is supported by the fact that the puncture is often closed at its mouth as also from what we know of the similar oviposition in other orders of insects. The facts, for instance, connected with the oviposition of *Pronuba yuccasella*, where the egg is thrust deep into the ovarian cavity of the Yucca pistil bear out this view. The egg, in this case, as it passes down the ovarium has not a definite pedicel or stalk, but becomes a mere thread in passing through the ovipositor (the nature of which precludes any external outlet during the passage), and the fluids gradually concentrate in the apical or anterior end as the embryo develops. Moreover, it is passed into the ovarian cavity and has no connection through the pedicel with the exterior wound which is closed long before the larva hatches.*

The great service which Adler rendered in the study of the gall-flies was, however, to establish the fact of alternate generation in so many cases. He thus proved the existence of alternate generation in the following species: (See opposite page.)

The writer established, by breeding, the connection of the agamic *Callirhytis operator* O. S. and *C. operatola* Riley in 1872, the facts and specimens having been communicated to

*This fly produces an undescribed vesicular bud-gall from which issues a small black winged bisexual species (*Dryophanta vesiculoides* M S. mihi). The gall produced by this and from which the apterous agamic generation comes is not yet known, though it will probably be a leaf-gall similar to that of *Acraspis erinaceæ* Walsh.

* *Vide* the Yucca Moth and Yucca Pollination, by Charles V. Riley (from the Third Annual Report of the Missouri Botanical Garden). Issued May 28, 1892.

No.	Parthenogenetic Generation.	Flies Emerge.	Sexual Generation,	Flies Emerge.
1.	Neuroterus lenticularis	April	Spathegaster baccarum	June
2.	" læviusculus	March / April	" albipes	June
3.	" numismantis	April	" vesicatrix	June
4.	" fumipennis	May	" tricolor	July
5.	Aphilotrix radicis	April / May	Andricus noduli	August
6.	" Sieboldi	April / May	" testaceipes	August
7.	" corticis	April / May	" gemmatus	July / August
8.	" globuli	April	" inflator	June / July
9.	" collaris	April	" curvator	June
10.	" fecundatrix	April	" pilosus	June
11.	" callidoma	April	" cirratus	June
12.	" Malpighii	April	" nudus	June
13.	" autumnalis	April	" ramuli	July
14.	Dryophanta scutellaris	Jan. / Feb.	Spathegaster Taschenbergi	May / June
15.	" longiventris	Nov.	" similis	May / June
16.	" divisa	Oct. / Nov.	" verrucosus	May / June
17.	Biorhiza aptera	Dec. / Jan.	Teras terminalis	July
18.	" renum	Dec. / Jan.	Trigonaspis crustalis	May / June
19.	Neuroterus ostreus*	Nov. / March	Spathegaster aprilinus	May / June

H. F. Bassett July 10th of that year, though not published till 1873. The synoptical table by Straton does not add to the list as originally published by Adler. The subsequent discoveries have not been many, it is true,† but their inclusion would have increased its value. The facts incidentally recorded in this review add two other American cases to the list, though the alternate gall in one instance has not yet been discovered. It is not difficult to observe these gall-flies in the act of oviposition and to follow up the investigation until the resulting gall is produced, and there is a wide and most interesting field of inquiry which offers rich results for any American biologist who has the time to take it up seriously. The coupling of the alternate galls with each other is, however, more difficult, by direct observation, and is to be arrived at rather from careful identification of the flies in connection with the galls they have been reared from. Even in an epoch-making work like Adler's, the conclusions respecting some of the most interesting problems connected with the economy of galls and gall-flies may yet be questioned, as indicated in this review, and there is unlimited opportunity for careful and conscientious direct observation in a field where experience shows that analogy and sweeping generalizations are often misleading.

C. V. RILEY.

WASHINGTON.

*Franz Löw (Verh. Zool.-Bot. Gesellsh. in Wien, XXXIV., 1885, p. 324) has given good reasons for believing that there was an error here, and that the agamic form of *Neuroterus aprilinus* Gir. is *Neuroterus Schlechtendali* Mayr. It should also be noted that Spathegaster is synonymous with Neuroterus.

† I now only recall, besides those already mentioned in this notice, *Chilaspis nitida* Ger. as the agamic form of *C. löwii* Wachtl., and *Dryophanta cornifex* Hart., as the agamic form of *Syntomaspis lazulina* Först..